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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/682,411	08/30/2001	Zheng Tang	45283.4	7773

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EDWARD YOO C/O BENNETT JONES
1000 ATCO CENTRE
10035 - 105 STREET
EDMONTON, ALBERTA, AB T5J3T2
CANADA

EXAMINER	
CREPEAU, JONATHAN	

ART UNIT	PAPER NUMBER
1746	

DATE MAILED: 02/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/682,411	TANG ET AL.	
	Examiner	Art Unit	
	Jonathan S. Crepeau	1746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 November 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *11-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *11-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This Office action addresses claims 11-23. The claims remain rejected under 35 USC §103 herein. As such, this action is made final.

Claim Rejections - 35 USC § 103

2. Claims 11, 15-17, and 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 2-87472.

Regarding claims 11 and 15, the reference is directed to a solid oxide fuel cell comprising an electrode layer (2, 3) applied to an electrolyte layer (1). The electrode layer comprises discrete elements separated by substantially uniform gaps (see abstract; Fig. 5). As shown in Figure 6C, the discrete elements appear to have a generally circular shape and are evenly and uniformly spaced.

JP '472 does not expressly teach that the discrete elements are polygonal in shape, particularly hexagonal, as recited in claims 11 and 15-17, or that such polygons or hexagons have parallel edges.

However, the claimed shapes of the discrete elements are a matter of choice which a person of ordinary skill in the art would have found obvious, absent sufficient evidence to the contrary (MPEP §2144.04 (IV)). As such, the claimed polygonal and hexagonal shapes of the discrete elements are considered to be obvious to a person of ordinary skill in the art.

The reference also does not expressly teach that the gaps between elements take up less than about 5%, 2%, or 1% of the surface area of the electrode, as recited in claims 11 and 21-23.

However, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be sufficiently motivated to make the gaps as thin as possible in the interest of increasing contact area and decreasing electrical resistance. Accordingly, Applicants' claimed ranges are also not considered to distinguish over the reference. Furthermore, the recitations of linear gaps, uniform gaps, and parallel edges would also be rendered obvious due to the close packing of the hexagonal electrode elements on the electrolyte sheet.

3. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP 2-87472 as applied to claims 11, 15-17, and 21-23 above, and further in view of Carolan et al (U.S. Patent 5,750,279).

JP '472 does not expressly teach that a contact paste is coated on the electrode, as recited in claim 18.

Carolan et al. is directed to a solid oxide fuel cell. In column 6, lines 23-28, the reference teaches a conductive paste located between the electrode and interconnector.

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to use the

conductive paste of Carolan et al. between the electrode of JP '472 and an interconnector. In column 13, line 41, Carolan teaches that "[t]he conductive material 340, 342 serves to direct electrons from the anode layer 326 to the interconnect layer 316, and from the interconnect layer 316 to the cathode layer 332." Thus, the artisan would be motivated to use the conductive paste of Carolan et al. between the electrode of JP '472 and an interconnector in hopes of improving electrical conductivity (i.e., decreasing electrical resistance) between the two.

4. Claims 12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 2-87472 as applied to claims 11, 15-17, and 21-23 above, and further in view of Ruhl et al (U.S. Patent 6,361,892).

JP '472 further teaches that the electrode layer is made by photo-etching in the abstract. However, the reference does not expressly teach that the electrode is made by screen-printing followed by sintering, as recited in claim 12.

Ruhl et al. is directed to a solid oxide fuel cell comprising an electrode layer applied to an electrolyte layer, which electrode layer comprises discrete elements (see col. 8, lines 39-42; Figs. 2 and 3). The electrode layer may be made by screen printing, etching, or photolithography, among other methods, which can be followed by sintering (see col. 6, line 29; col. 8, line 22 et seq).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the disclosure of Ruhl et al. indicates that

screen printing and photolithography (photo-etching) are equivalent methods for fabricating discrete SOFC electrode elements. As such, it would have been obvious to substitute the screen printing process of Ruhl et al. for the photolithographic process of JP '472. An express suggestion to substitute one equivalent component or process for another is not necessary to render such substitution obvious. *In re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982); MPEP §2144.06. Further, the sintering step disclosed by Ruhl would also be an obvious modification of the process of JP '472 because the solid oxide fuel cell of JP '472 would be operated at a high temperature that would require sintering of the components.

5. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP 2-87472 in view of Ruhl et al. as applied to claims 12 and 14 above, and further in view of Carolan et al (U.S. Patent 5,750,279).

JP '472 does not expressly teach that a contact paste is coated on the electrode, as recited in claim 13.

Carolan et al. is directed to a solid oxide fuel cell. In column 6, lines 23-28, the reference teaches a conductive paste located between the electrode and interconnector.

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to use the conductive paste of Carolan et al. between the electrode of JP '472 and an interconnector (separator). In column 13, line 41, Carolan teaches that "[t]he conductive material 340, 342

serves to direct electrons from the anode layer 326 to the interconnect layer 316, and from the interconnect layer 316 to the cathode layer 332." Thus, the artisan would be motivated to use the conductive paste of Carolan et al. between the electrode of JP '472 and an interconnector in hopes of improving electrical conductivity (i.e., decreasing electrical resistance) between the two.

6. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 2-87472 in view of Carolan et al. as applied to claim 18 above, and further in view of Singh et al (U.S. Patent 5,516,597).

Carolan et al. further teach that the conductive material may be formed from an electrode material (see col. 6, line 26). However, Carolan et al. do not expressly teach that the conductive material is lanthanum cobaltate, as recited in claim 19.

Singh et al. is directed to a solid oxide fuel cell. In column 6, line 52, Singh et al. teach the following:

> niques. The air electrode is typically comprised of doped and undoped mixtures of metal oxides such as $LaMnO_3$, $CaMnO_3$, $LaNiO_3$, $LaCoO_3$, $LaCrO_3$ and other electrically conducting metal oxides. The dopants are typically Sr, Ca, Co, Ni, Fe, Sn, Ba, Ce or the like. The preferred air electrode

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated by Singh et al. to use lanthanum cobaltate as the conductive material of Carolan et al. Carolan et al. disclose

that a suitable material is electrically conductive or an electrode material. In the passage above, Singh et al. identify $LaCoO_3$ as being electrically conducting and an electrode material. The selection of a known material based on its suitability for its intended use has been held to be *prima facie* obvious (MPEP §2144.07). Thus, the artisan would have been sufficiently skilled to use $LaCoO_3$ as the conductive material of Carolan et al.

Response to Arguments/Declaration

7. Applicant's declaration under 37 CFR §1.132 has been carefully considered but is not persuasive in overcoming the outstanding rejections. Applicant states that in JP '472, one is not motivated to tightly pack the elements. However, on page 5 of the translation, the reference teaches that the diameter of the electrode with dots "can be controlled as needed within the range from 0.1 to 10μm," and that the distance between the electrodes with dots "can also be controlled as needed within the range from 0.1 to 10μm." Thus, the reference permits wide latitude in choosing the size of the dots and the distance between them. This is not seen to "teach away" from tightly packing the dots.

Applicant further states that the electrodes of the reference are vapour deposited, and that "a vapour deposited electrode material, such as lanthanum cobaltite, will be fully dense and non-porous." This is cited as motivation for not tightly packing the electrodes, since gas must reach the *sides* of the electrodes in order to react. However, it is believed that there is not yet sufficient evidence of record to show that laser physical vapor deposition as disclosed in the reference

inherently produces a film that is non-porous to hydrogen. The reference teaches that it is an object of the invention to increase the porosity of the electrodes; however, the reference does not expressly teach that the electrode dots *per se* are nonporous. On page 5 of the translation, the reference does teach that "[b]oth side surfaces of the electrodes with stripes and dots are preferably formed into projections and recesses so as to accelerate the electrolyte reaction to solid electrolyte layer 1." This clearly states that gas reaching the sides of the electrodes is advantageous, but it still not believed to be indicative that this is the *sole* mode of operation of the fuel cell.

Additionally, with regard to the porosity of a PVD-produced layer, U.S. pre-grant publication 2004/0180252 to Wortman et al. is cited herewith. In paragraph [0022], this reference teaches that fuel cell electrodes may be made by a number of PVD processes including laser ablation. Further, in paragraphs [0023] and [0024], the reference teaches that the PVD processing parameters may be configured to produce coatings having gradients in composition, grain size, and porosity. As such, the reference is taken as evidence that PVD-produced electrode layers are not inherently non-porous.

It is further noted that some of the instant claims recite that the surface area taken up by the gaps is less than a specific value, and other claims (i.e., claim 15) merely recite that the gaps are "uniform." It is submitted that at a minimum, it is necessary to include some quantitative measure of the size of the gaps in all of the independent claims. This way, if it can be shown that the electrodes of the JP '472 reference are in fact non-porous, then it may be said that the reference does not fairly suggest such a small surface area of gaps on the surface. As noted above, some of the claims, as presently drafted, merely recite "narrow" and/or "uniform" gaps.

The former is essentially a relative term which does not relate the size of the gaps to the size of the electrode elements, and the latter would be a result of using polygons. As such, it is believed that quantitative recitations of gap size should be included in the independent claims.

Conclusion

8. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

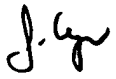
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Crepeau whose telephone number is (571) 272-1299. The examiner can normally be reached Monday-Friday from 9:30 AM - 6:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr, can be reached at (571) 272-1414. The phone number for the

organization where this application or proceeding is assigned is (571) 272-1700. Documents may be faxed to the central fax server at (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Jonathan Crepeau
Primary Examiner
Art Unit 1746
February 8, 2005